

THURSDAY, MARCH 25, 1886

## THE GREELY ARCTIC EXPEDITION

*Three Years of Arctic Service. An Account of the Lady Franklin Bay Expedition of 1881-84, and the Attainment of the Furthest North.* By Adolphus W. Greely, Lieutenant U.S. Army, Commanding the Expedition. Two Vols. (London: Bentley and Son, 1886.)

THE principal incidents of this wonderfully successful and singularly unfortunate Expedition must be familiar to most of our readers. It formed one of the series of International Polar Stations which carried on a year's observations all round the Polar area in 1882-83. The Greely Expedition, however, took up its quarters at Fort Conger (81° 44' N., 64° 45' W.), Discovery Harbour, Lady Franklin Bay, in August of 1881. This, it will be remembered, was the station of the *Discovery* in the last English Expedition. The Expedition consisted of twenty-five men, all told. So far as organisation goes, the Expedition was a military and not a naval one, under the U.S. Signal Service, which is attached to the War Department. It was certainly a mistake not to have had the naval element substantially represented on such an expedition, and a still greater and more fatal blunder not to have provided the party with a ship in which they might have escaped in case no relief party reached them. No time was lost after landing in erecting a substantial wooden house, observatory, and the various instruments with which the scientific work of the Expedition was to be carried on. Observations in all departments of meteorology seem to have been faithfully and regularly taken according to the prescribed programme, and we have no doubt that most of them were preserved and taken home in the rescue ship. Only a few of the results are given in the appendixes to these volumes; the observations themselves will doubtless be sent to the Central Committee to be worked out along with those from other stations. Under the very efficient guidance of Major Greely excellent work of various kinds was carried out in the autumn of 1881 and the spring and summer of 1882. The relief vessel which was sent out in the latter year failed to come near Fort Conger, and the party, well provided, continued their work in the autumn of 1882 and up to the end of August 1883. Two vessels were sent out in the summer of 1883 to reach Fort Conger, but through incredible mismanagement, completely failed in fulfilling their mission, and even carried back with them the bulk of the provisions which they ought to have cached at certain points for the sustenance of the retreating party. It seems a strange perversity and a remarkable piece of red-tapeism in the U.S. Government to have intrusted these relief expeditions entirely to military men. It would surely have been easy to get experienced Arctic navigators for such critical work, and so probably have saved the lives of the poor men who were practically without the means of saving themselves. According to instructions, Major Greely, since no relief reached him, abandoned his station at Fort Conger on September 1, 1883, and with all his men, who up to this time had enjoyed excellent health on the whole, made his way south in a small steam launch and a boat or two, through

almost impassable ice. In the end they were forced to land at Cape Sabine about the middle of October, and here, with scarcely any shelter, with only about enough food to sustain one man in these regions, and under the most miserable meteorological conditions, on the bleakest spot in all the Arctic, did these men drearily drag themselves through the winter. When at last Commander Schley did reach the spot in June 1884, he found only six out of the twenty-five alive. Yet up to within a few days of the rescue, such observations as were possible were carried on, and the conduct of the men, on the whole, was as noble as could be imagined. This fearful sacrifice of life is deplorable, all the more so when it is remembered that it was due to blundering and half-heartedness on the part of those at home. It is easy to ask whether the gains to science are worth all this sacrifice to human life, but the question is not so easily answered. And whatever the answer is, we may be sure that the Greely disaster will never deter humanity from attempting to find out all about the remotest and most inhospitable corners of its little home.

During the two years that the Expedition remained in Grinnell Land, it did some admirable work, in addition to the scientific observations carried out in the neighbourhood of the station. One of the most efficient and bravest members of the Expedition was Lieut. Lockwood, who, alas, did not return to reap the reward of his splendid work. He, along with Sergeant Brainard (who, we are glad to believe, will receive an acknowledgment of his services from the Royal Geographical Society), carried the coast of Greenland far beyond the furthest point reached by Beaumont in the Nares Expedition. In doing this, Lockwood reached the furthest point northwards yet attained, 83° 23' 8" N., only three or four miles beyond Capt. Markham's farthest. Of course he was quite justified in waving the Stars and Stripes over this triumph; though it should be remembered that it is a very different thing to travel along an Arctic coast to trudging straight Polewards over palæocrystic ice. As far as Lockwood reached, the coast of Greenland is broken up by fjörds, and skirted with islands, while the interior seemed an ice-bound land. There now remains only a comparatively small section of the north coast of Greenland to lay down, in order to join the furthest points east and west; and it is much to be wished that this section were completed. At the same time if an expedition were sent out specially for the purpose, it would be desirable to endeavour to penetrate southwards into the Greenland interior, to test Sir Joseph Hooker's conjecture, "that vegetation may be more abundant in the interior of Greenland than is supposed, and that the glacier-bound coast-ranges of that country may protect a comparatively fertile interior." It was in search of a green interior, it will be remembered, that Baron Nordenskjöld made his remarkable journey a few years ago. He failed to find what he sought for, probably because he struck too far south.

In another direction Sir Joseph Hooker's prophetic faculty has been amply sustained. "We are almost driven to conclude," he wrote in 1877, "that Grinnell Land as well as Greenland, are, instead of ice-capped, merely ice-girt islands." The most noteworthy and novel geographical work done by the Greely Expedition was the

exploration of this same Grinnell Land. Previously we only knew its coasts and the country bordering on them in the neighbourhood of Discovery Harbour. Aldrich carried the north coast as far west as  $85^{\circ}$  W. long. Much of this outline has now been filled up. Archer Fjörd has been traced to its head; a large portion of the interior has been opened up; while on the southern coast another fjord, Greely Fjörd, has been discovered, and the coasts beyond seen stretching northwards and southwards. In the spring and summer of 1882 Greely himself made two considerable journeys into the interior, when he made discoveries which form an important addition to our knowledge of the physical geography of the Arctic regions. Bordering on  $82^{\circ}$  N. is a considerable freshwater lake (Hazen), skirted on the north by the lofty Garfield and United States Ranges and westwards by the Conger Mountains. Around Lake Hazen are a series of small lakes, and many streams which send their waters into Lake Hazen. Even in April the river which discharges into Chandler Fjörd was found quite open in part of its course, and the country generally remarkably free of snow. In summer the valleys give birth to a comparatively luxuriant vegetation, which serves as pasturage for considerable game. Besides grass in plenty, willows, beds of dryas and saxifrages were common; butterflies added brightness and gaiety to the scene; bumble-bees and "devil's darning-needles" flitted about. Ample remains of recent Eskimo settlements were found, and fossil testimonies to the former temperate character of the climate and the recent elevation of the whole region. Unfortunately, though very excellent collections seem to have been made, none of the members of the Expedition were specially qualified to make the most of the rare opportunity for thorough scientific investigation. Many Eskimo relics were collected, but a study on the spot of the sites of dwellings and remains by one skilled in such investigations would have yielded valuable results to ethnology. Still Major Greely and his men did their best, and the collections they made and information they collected will form important and welcome additions to science. Even on the south side of Archer Fjörd, near Cape Baird, a fossil forest was discovered, one tree over a foot in diameter being found at an elevation of 800 feet above the sea. Of Grinnell Land Major Greely writes: "This fertile belt, 150 miles long and 40 wide, extends from Robeson and Kennedy Channels to Greely Fjörd and the Western Polar Ocean. Its iceless condition depends entirely on its physical configuration. The abrupt, broken character of the country makes it impossible for the winter's scanty snow to cover it. Long, narrow, and numerous valleys not only offer the greatest amount of bare soil at favourable angles to the heating rays of the constant summer sun, but also serve as natural beds, with steep gradients, for the torrents from melting snows. The summer rivers drain rapidly the surface water, and long before continuous and sharply-freezing weather comes, the land is generally free from snow, and the large rivers have dwindled to brooks. The deep intersecting fjörds not only receive the discharging rivers, but, from their frozen surfaces, furnish large quantities of saline efflorescence, which, mixing with the land-snow, facilitates greatly its disappearance in the coming spring. Where such conditions do not prevail in Grinnell Land,

ice-caps are found similar to the inclosed ice of Greenland traversed by Nordenskjöld."

Abutting on the north shore of Lake Hazen through a gap in the Garfield Range, is a magnificent glacier, with a convex face some five miles long, and 150 feet high, an outlier of the great ice-cap which covers all the north of Grinnell Land. Major Greely estimates the area of this northern ice-cap at 3000 square miles. "There is but little doubt," he says, "that the Challenger Mountains bound this ice-cap to the north-west, and that its northern face drains through Clements Markham Inlet, and the many ravines which Aldrich speaks of as running far inland from the bays on the shores of the Polar Sea."

Similarly on the south side of this Arctic oasis Lockwood and Brainard found a magnificent glacial wall extending between Archer Fjörd and Greely Fjörd, with a vertical face of an average height of 150 feet. From one mountain the wall was seen trending for forty miles to the south-west. The surface of the *Agassiz mer-de-glace* itself is very elevated, and extended southwards as far as the eye could reach. Lockwood thought that it must be of enormous depth in the interior. No moraines or foreign matter of any kind were observed on the surface, and crevices were extremely few and insignificant. Of moraines along the wall there were very few. The wall was generally of a uniform white colour. The ground to the north of it, especially on the divide, had a singularly smooth appearance, as if it had once formed the base of this mass of ice. We have here evidently a region of singular interest, well deserving the study of the geologist, and especially of the palæontologist.

Major Greely devotes a chapter to Polar ice, in which he describes some of its more usual forms; this having already been very exhaustively done by Nordenskjöld in his "*Voyage of the Vega*." Major Greely, however, specially discusses the formation of palæocrystic ice. It will be remembered that Sir George Nares attempts to account for the formation of these enormous thick masses of floating ice by supposing that they are due to successive accretions at the base. Major Greely rebuts this hypothesis, and maintains that the origin of palæocrystic bergs is similar to the flat-topped bergs of the Antarctic. He believes that the ice is in origin a land-formation, probably the accumulation of centuries on some islands far to the north of Grinnell Land; that it gets shunted off into the sea, and is floated southwards towards Robeson Channel. We suspect that neither hypothesis can be considered satisfactory; and though we do not think Major Greely has much to advance in favour of his hypothesis, his description of the structure of these great floes is at least instructive. The tidal observations made regularly during the two years are likely to lead to valuable results. Not only were observations taken at Fort Conger, but simultaneous observations, when possible, were taken along Grinnell Land coast. These, combined with the observations of 1875 and those of Bessel in 1871, may enable us to determine satisfactorily the cotidal curves of Robeson and Kennedy Channels and the entrance to the Polar Sea.

Much exploration, it should be said, was also carried out along all the coasts around the Station, and Dr. Pavy made an unsuccessful attempt to push northwards from Cape Joseph Henry. Very fair supplies of

musk oxen were met with, and no doubt had the Expedition disobeyed instructions and remained at Fort Conger, it would have been saved most of the hardships it encountered, and all the members might have been saved alive. Much valuable scientific matter will be found in the appendix—ethnology, botany, ornithology, Medusæ, &c. One of the most striking and instructive features about these handsome volumes is the beauty and accuracy of the illustrations. They are most of them from photographs, and are fine examples of the services which photography can render to science. The texture of rocks and ice in these illustrations is wonderful.

The narrative itself, though quite unvarnished, is of intense interest; and the Expedition was in many ways one of the most remarkable ever sent Polewards.

*THE KRAKATŌ DUST-GLOWS OF 1883-84*  
*Beobachtungen über die Dämmerung insbesondere über das Purgelicht und seine Beziehungen zum Bishop'schen Sonnenring.* Habilitationsschrift der philosophischen Facultät der Universität Basel vorgelegt von Dr. Albert Riggenschbach. (Basel: H. Georg's Verlag, 1886.)

THE Krakatō dust-gloWS of 1883-84 have already created a not inconsiderable literature. To this the pamphlet now before us is a contribution of some value. The writer has not only diligently studied the observations of others, but has added a long series of his own, and has thus acquired a right to an attentive hearing on the subject of the remarkable appearances which have given rise to so much discussion.

Scientific opinion has all but unanimously adopted the volcanic hypothesis of their origin urged with irresistible logic by Mr. Lockyer in the *Times* of December 8, 1883. It is admitted, though not examined, by Dr. Riggenschbach; whose concern is less with the primary cause of the phenomena than with the minute machinery of their production. Questions bearing on the general physics of the globe are left untouched, while attention is concentrated on the intricate optical problems connected with the variegated tints of our skies.

These, according to our author, result mainly from diffraction. But absorption and reflection also play each an indispensable part. The sunset-sky, it must be remembered, is illuminated only by a residuum of sunlight. A long journey across the densest strata of the atmosphere has robbed it of all its more refrangible constituents. The course of the surviving rosy beams is interrupted by encounters with innumerable fine particles of solid matter, always, in greater or less quantity, suspended at considerable heights above the earth's surface. These form fresh points of divergence, whence rays which would otherwise have been transmitted unseen, reach the eye, either directly, or after reflections from interposing veils of fine cloud. Thus, the hurling into the air of 150 cubic kilometres of volcanic dust in August 1883, served only to intensify pre-existent conditions for the production of twilight-pageantry, not to create new ones. What we might almost call the solid constituents of our atmosphere were not alone largely increased in amount, but the added dust-supplies were of unusual fineness, consequently floated at unusual elevations. Displays of colour hence gained both in splendour and duration.

The effects of this strange reinforcement from the antipodes did not, however, manifest themselves at sunrise and sunset only. On September 5, 1883, Mr. Sereno G. Bishop first noticed at Honolulu a peculiar white halo of a pinkish tint encircling the sun (*NATURE*, vol. xxix. p. 260). The phenomenon had never previously been observed, and is now known as "Bishop's Ring." It was perceived later in Europe, and proved extraordinarily persistent. For fully two years, whenever the air was sufficiently clear, it continued visible, thus long outlasting the twilight-gloWS, with which, nevertheless, it was most intimately connected. Dr. Riggenschbach observed that the rosy illumination began to show after the sun had dipped below the horizon, precisely at the same angular distance from his limb with the maximum intensity of the ring or "corona." And it may be taken as ascertained that the latter was purely an effect of diffraction. The succession of colours was the opposite to that seen in an ordinary halo, the blue lying *inside*; while the diameter (measured to the middle of the red zone) was about 28°, that of the refraction-halo being 45°. The observed dimensions of the ring gave the means of calculating the size of the particles concerned in producing it; and they were accordingly found by Prof. Hagenbach to be 0.003 mm., by M. Flügel 0.001 mm. in diameter. Yet, though far finer than the minute vesicles occasioning the diffraction-rings frequently observed in comparatively close proximity to the sun and moon, their bulk (even adopting the lower estimate) would still be at least one million times that assigned by Sir William Thomson to the ultimate atoms of matter.

Seen from the Bernese Oberland, or other high ground in Switzerland, during the summer and autumn both of 1884 and 1885, this curious aureola presented a striking appearance. A silvery field of diffused radiance extended to about 10° from the sun's limb, and was terminated by coloured circles, the prismatic order of which grew distinct in proportion as the air gained transparency. Below 1000 metres of elevation, the whole phenomenon became effaced. It was independent of meteorological conditions, taking its origin in a region of the atmosphere beyond the reach of ordinary disturbances. The invariability of its presence was painfully experienced by Mr. C. Ray Woods during his sojourn on the Rifel in the summer of 1884. No more effectual obstacle to the work of photographing the sun's proper corona can indeed be imagined than that which, by a linking of causes not difficult to trace, though impossible to foresee, was interposed by the memorable eruption two and a half years ago in the Sunda Straits.

#### OUR BOOK SHELF

*The Star Guide.* By Latimer Clark, F.R.A.S., and Herbert Sadler, F.R.A.S. (London: Macmillan, 1886.)

THIS is a most useful and carefully planned guide to the best use of small telescopes. It consists of a list of the most remarkable celestial objects visible with such instruments, with their positions for every tenth day, and partly serves as an introduction to Webb's "Celestial Objects for Common Telescopes." Very considerable trouble has been taken in the compilation of the table of double-stars. Test objects, lunar craters, shooting-star radiants are also catalogued, and although small apertures